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FPM *Technology Update*



Issue No. 92-1

May 1992

Kiwis Can't Fly - But Airborne Video Flies in New Zealand

In January of this year, at the request of the New Zealand Ministry of Forestry, Forestry Research Institute (FRI), a USDA-Forest Service team traveled to Rotorua, New Zealand, to assist in the demonstration and evaluation of airborne video technology. The U.S. team included Jim Space, Director, Forest Pest Management (FPM); Bill White, Assistant Director, FPM; Ross Pywell, Program Manager, FPM/Method Applications Group (MAG); Bruce Silvey, Resource Computer Specialist, National Forests in Texas and FPM/Region 8; and Brian Orland, Professor, University

of Illinois. The New Zealand evaluation team was led by Gordon Hosking, FRI, Forest Health, and included William Shaw, New Zealand Department of Conservation (DOC), John Firth, Logging Industry Research Organization (LIRO), and Rod Brownlie, LIRO.

The purpose of the visit was to provide the opportunity for people involved in various aspects of resource management in New Zealand to evaluate airborne videography as a potential remote sensing tool. This included training and hands-on use of both the video acquisition and image processing systems, and seminars for both technical personnel and upper-level management.

Upon arriving in Rotorua, Bruce Silvey installed MAG's video camera system in the New Zealanders' Cessna 180 aircraft, set up his computer system (containing the Map and Image Processing System (MIPS) software) in LIRO's photogrammetry lab, and began training FRI personnel in the use of the video camera system. After three days, the FRI and LIRO personnel were installing

the equipment in the aircraft each morning and flying their own image-acquisition missions without the U.S. team in the aircraft. This is testimony to the transferrability of airborne video technology, and allowed the U.S. team to concentrate on training people in the use of the image-processing software and conducting demonstrations of the collected imagery for numerous people from FRI, LIRO, DOC, and timber companies.

Over the three-week period, several hours of video imagery were collected covering applications in forest management, forest health, soil nutrition, timber sale monitoring, indigenous forest monitoring, wetland mapping, agricultural shelterbelts, weed and shrub invasion, agricultural pests, and erosion. In addition to the evaluation team, numerous other individuals were trained to operate the video camera system well enough to be capable of flying their own image-acquisition missions. Once the imagery was obtained, it was brought back to the lab for viewing and evalua-

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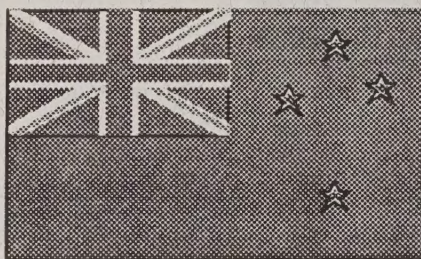
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The Forest Pest Management Methods Application Group publishes *FPM Technology Update* semi-annually and distributes it nationally to FPM personnel and others interested in forest pest management. The newsletter seeks to link FPM/MAG with field personnel and inform them of program activities and status, model availability, upcoming models and their release dates, and current related news. We invite your comments and suggestions on how we can keep you informed and better serve you. If you have items of interest or comments, or wish to be added to our mailing list, contact:

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tion. In some cases, imagery was brought into MIPS for analysis and used to update data layers imported from FRI's TerraSoft GIS.

Three seminars were held to present video and associated technology to as wide an audience of potential users as possible. One half-day seminar was held for technical personnel within FRI and LIRO. This seminar focused on technical presentations of the video capture and analysis systems, and addressed anticipated future developments. A second, all-day seminar was conducted for all interested parties, and included representatives from FRI, LIRO, DOC, the Ministry of Forestry, and timber companies who own and manage all of New Zealand's commercial forest land. This seminar focused on the capabilities of airborne video and the initial results of the New Zealand evaluation project. A third seminar, covering data visualization techniques and INFORMS, was given by Brian Orland and Bill White.

A comprehensive report titled "Airborne Video Evaluation Report" by G. Hosking, W.

Shaw, J. Firth and R. Brownlie has been prepared by the New Zealand evaluation team covering all applications tested during the project. In addition, a follow-up visit to MAG offices by Gordon Hosking, the evaluation team leader, has been scheduled for August. At that time, Gordon will also present the results of the evaluation in a paper at the Resource Technology 92 conference in Washington, DC. For more information or copies of the evaluation report, contact Ross Pywell at (303) 498-1705. 

Chinese Delegation to Visit United States

Representatives from the People's Republic of China, Ministry of Forestry will be visiting FPM/MAG offices in Fort Collins, CO, from May 14-16. The delegation will evaluate the situation for monitoring forest pests in China by using the U.S. forest health monitoring and evaluation abilities, especially aerial videography.

Representatives from the United States will meet the Chinese delegation in San Francisco and travel with them to Oregon, Colorado, Texas, Pennsylvania, Washington DC, and Virginia. Representatives from both countries hope the visit will promote an exchange of personnel and technology that will enhance the forest health protection of both China and the United States. 

Advanced Technology Program...

Vermont Hardwoods Video Comparison

During the summer of 1991, Carl Sumpter and Barry Russell, contractors with the FPM/MAG Advanced Technology Program in Fort Collins, Colorado, joined the FPM Durham, New Hampshire, Field Office and the Vermont Department of Forest, Parks, and Recreation personnel in Burlington, Vermont, to conduct a test of the capabilities of airborne videography.

Their objective was to determine the extent to which different coverage widths (in effect, different scales) of video could supplement or enhance the use of color infrared (CIR) photography in the detection of forest insect and disease damage. The test was conducted by flying the same 2.5-acre test plot of a Vermont hardwood forest adjacent to Lake Champlain at varying height and lens settings to yield video coverage widths of 1/2, 1/4, and 1/8 mile.

The S-VHS video tapes, 1:8000-scale CIR photography, and associated maps were brought back to MAG's Fort Collins facility in February for analysis. Early on, Ross Pywell, Dick Myhre, and Margaret Miller-Weeks assisted the project team with the identification of testing parameters and the definition of the five damage classes that would



be used in the image-interpretation process. Image analysis was accomplished by Bill Frament and Tom Luther (Forest Health Protection, Durham, New Hampshire), Ron Kelley (Vermont Department of Forest, Parks, and Recreation), and Lowell Lewis (contractor, MAG, Ft. Collins).

Individual video frames for each coverage width were selected, electronically "grabbed," and digitally stored as images by the Map and Image Processing System (MIPS) pc-based image-processing software package. Individual "grabbed" images were arranged (tiled) together as required to make up the three flight lines of the test plot. The United States Geological Survey (USGS) Ticonderoga, New York-Vermont quadrangle map was scanned into MIPS and registered to geographic (latitude/longitude) coordinates. All other photos and tiled video images were then registered in

Remote Sensing Conference

The Fourth Biennial Forest Service Remote Sensing Conference on "Applications of Remote Sensing Technologies for the Protection and Management of Natural Resources" was held April 6-10, 1992, in Orlando, Florida. Approximately 225 people attended the technical presentations, poster displays, vendor exhibits, evening workshops, and a field trip/tour of NASA's Kennedy Space Center.

FPM was one of several co-sponsors of the conference. Approximately 20 FPM personnel from across the country attended the conference and presented these papers:

"Applications of Airborne Videography for Forest Health Monitoring, Vermont Pilot Test - 1991" by William Frament, Forest Health Protection, Durham, NH

"An Airborne Video System Developed within Forest Pest Management - Status and Activities" by Richard Myhre, Methods Applications Group, Fort Collins, CO

"The Use of GPS, GIS, and Remote Sensing in Post-Fire Evaluation to Determine Insect Populations" by Carl Sumpter, contractor with the Methods Application Group, Fort Collins, CO.

A working group meeting was held for all FPM attendees to discuss remote sensing and related technology activities going on within FPM. □

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... Advanced Technology Program. . .

AVS Training

FPM/MAG conducted a video training session on March 10-12 for groups that purchased the video systems that MAG developed. Approximately 25 participants attended, representing both state and Forest Service units. The instructors for the session were Dick Myhre of FPM/MAG, and Barry Russell, and Carl Sumpter, contractors with MAG. Mission planning, airborne operations, and aircraft installation of the camera system were a few of the subjects covered during the training.

All students were issued a draft copy of the Airborne Video System Users Guide for use during the training, and were asked to make note of any changes or additions they would like to see in the users guide. These additions will be incorporated into the final edition of the manual, to be

completed by August of this year.

Course evaluation sheets were also passed out at the end of the training, and students were asked to make remarks on the training session and how MAG instructors might better present the material during future training sessions. Many positive comments regarding the training were noted. □

ATP Anticipates an Active Summer of Flying

The Remote Sensing Acquisition and Aircraft Project (RSAAP), under the leadership of Dick Myhre, Remote Sensing Specialist, is part of MAG's Advanced Technology Program. RSAAP, in cooperation with Region 2 (R-2) Aviation Management, will provide an aerial platform (Beechcraft Queen Air) for remote sensing development

and testing activities, and aerial photography and airborne video mission support to the field for the summer of 1992.

The following list shows the variety and scope of the summer's anticipated missions, and the cooperating organizations:

- California - photography of Forest Health Monitoring plots (R-5/FPM)
- Idaho - video for noxious weeds and range management applications on the Nezperce National Forest
- Colorado - photography of root disease activity on the Ute Indian Reservation (Bureau of Indian Affairs and R-2/FPM)
- W. Virginia - video evaluation for Gypsy Moth mapping (Northeast Area/FPM)
- Kentucky - evaluation of a

See Flying on page 10

Advanced Technology Lab

The MAG Advanced Technology Program Lab offers the opportunity for FPM field personnel to work directly with technical specialists at MAG through cooperative projects and short-term details, enabling field personnel to gain experience in remote sensing, image processing, GIS, and GPS by working with their own

projects and data in a hands-on environment. This provides not only a training opportunity for users, but also allows them to evaluate the utility of these technologies for their own applications without making a large capital investment.

The lab currently has both the MIPS and ERDAS image processing systems; GRASS,

ARC/INFO, and Genamap geographic information systems; two Trimble Pathfinder GPS units; and a GPS community basestation.

Any field unit interested in developing cooperative projects or conducting evaluations of these technologies should contact Ross Pywell at (303) 498-1705, or R.Pywell:W04A.

GPS Happenings

The world of global positioning systems (GPS) is expanding at the MAG's Fort Collins, Colorado, facility. Through an agreement between Region 2 and MAG, a Trimble Navigation GPS Community Basestation, for use with Trimble's Pathfinder GPS receivers, has been installed in MAG's Advanced Technology Lab. The basestation can be used for post-processing differential corrections to GPS field data collected within a 300-mile radius of the station. The usable area includes most of Colorado, the southern Black Hills of South Dakota, and the southeastern portion of Wyoming.

The use of a community basestation means more GPS receivers are available for field use, as a second GPS receiver is not needed to act as a basestation for use with post-

processing differential corrections. The Fort Collins basestation files will be available via the Data General (DG) system for use in performing differential corrections on the day following the field survey. The basestation files will be kept for a period of two weeks then deleted. The basestation will be operational between the hours of 6am to 6pm, seven days a week.

Any FPM personnel interested in technical assistance in applying GPS should contact Dick Myhre at 303-498-1778, or D.Myhre:W04A.

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a similar manner.

Next, the CIR photos of the test plot were stereoscopically viewed and the five damage classes were identified by traditional photo interpretation methods. The three coverage widths of video imagery were then interpreted on screen and the results were compared against the CIR results.

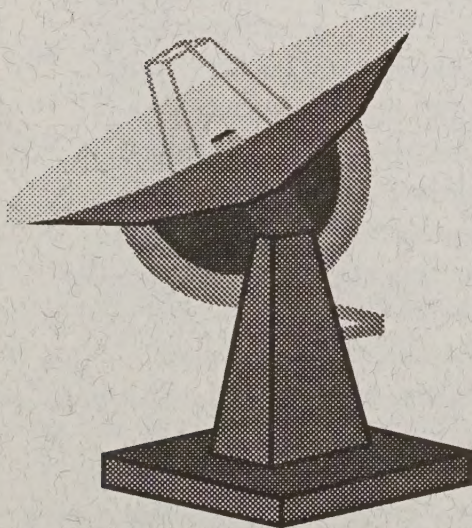
The comparison of video coverage interpretation to CIR photo interpretation revealed the following:

- The 1/2-mile coverage is adequate for detecting chlorotic and, to some extent, very large dead trees,

- The 1/4-mile coverage is superior for detecting chlorotic trees, and useful in detecting obvious occurrences of crown dieback, as well as recent and older dead classes, and
- The 1/8-mile coverage is adequate to superior for detecting all damage classes, except snags.

Chlorotic trees were more easily distinguished on the video imagery since video is displayed in true color (rather than CIR), which the human eye is more accustomed to viewing. On the other hand, snags were more easily distinguished on the CIR photos primarily because of the interpreter's ability to view in stereo and the higher resolution of the 1:8000-scale photography.

In addition to its detection capabilities, airborne video imagery is less expensive to acquire, is immediately available after acquisition for review of the imagery (to determine if re-flights are necessary), and can be digitally stored and recreated for further processing and analysis. This study concluded that airborne video imagery is a valuable supplement to CIR photography for forest health management applications. □



Quantitative Techniques Program. . .

Dwarf Mistletoe Model Improvements

The Interim Dwarf Mistletoe Impact Modeling System is available on the nine variants of the Prognosis Stand Growth and Yield Model that use version 6.1. It will be made available on the remaining variants in the near future.

The report entitled "Interim Dwarf Mistletoe Impact Modeling System: Users Guide and Reference Manual" (USDA Forest Service, Forest Pest Management / Methods Application Group. Report No. MAG-91-3, March 1992, 90 pp.) has been updated to reflect changes and corrections to the manual and the model. This March 1992 revision replaces the previous October 1991 version, and is available upon request from the Methods Application Group.

A mistletoe model design workshop was held March 12-13, 1992, in Portland, Oregon. Participants included model builders, plant ecologists, plant pathologists, wildlife biologists, statisticians, and systems analysts. Discussions focussed on modeling brooms and spiked tops and the interactions among forests, dwarf mistletoe, and wildlife, since mistletoe-induced brooms are often used as nesting sites and for cover by many species.

A model review workshop was held April 22-24, 1992, in Fort Collins, Colorado. The

model development contractor, Environmental and Social Systems Analysts Ltd., presented the mistletoe spread and intensification section of the comprehensive model. Participants discussed model behavior, keywords, and possible refinements, which will be made during the summer.

For more information on the Dwarf Mistletoe Model, or any Quantitative Techniques projects, contact Bov Eav, (303) 498-1784. □

Prognosis News

In an effort to identify users still computing at the National Computer Center-Fort Collins (NCC-FC), the Prognosis Stand Growth and Yield Model was removed from the Unisys computer in January. The pest extensions on the Unisys have been available per request only since May of last year. Both the Growth and Yield Model and the pest extensions are available to users on the DG or the IBM at NCC-Kansas City, Missouri.

There is a new Central Rockies (CR) variant for the Stand Prognosis Model, replacing the Black Hills, Southwestern Mixed Conifer, and Southwestern Ponderosa Pine variants. The CR variant also includes the spruce-fir model and lodgepole pine models. Updating of the pest models to the new CR variant will be

complete early this summer.

Updating the Prognosis Model variants to version 6.1 has continued, and now includes the Teton variant. There are only three variants left within version 6.0: Central Rockies, Klamath Mountains, and Southeastern Alaska. □

Pine Bark Beetle Model to be Developed in 1992

A joint FPM/MAG and Region 4 technology development project to build a generalized pine bark beetle model was funded in 1992. The project is planned as a multi-year effort to expand the scope of the Mountain Pine Beetle Pest Impact Model. The goal is to be able to predict damage caused by other pine bark beetles, such as Western pine beetle and Ips, and in Western pine types in addition to lodgepole pine.

A scoping meeting was held in 1991, with participants from FPM, Forest Service Research, and Canada. Based on the results of that session, the technology development proposal and a subsequent Request for Proposal for contract services was developed. A contract has been awarded to Environmental and Social Systems Analysts Ltd. (ESSA) to conduct structured workshops and to develop computer code. A model design workshop will be scheduled soon.

Vermont Hardwood Tree Health Resurvey

FPM/MAG's biometrician, Eric Smith, and Forest Service contractor, Changhua Chen, have completed the analysis of the 1991 Vermont Hardwood Tree Health Resurvey data. This project is a cooperative effort with the Vermont Department of Forests, Parks, and Recreation, and the Forest Health Protection unit of the Northeast Area at Durham, New Hampshire.

The project was begun because of concern over the effects acid deposition might be having on Vermont hardwoods.

The initial survey, based on both photo and ground plots, was completed in 1986. The 1991 resurvey shows that significantly fewer hardwoods now have crown dieback greater than 10%. Trees with 51 to 75% dieback in 1986 mostly improved so that they now have less than 10% dieback. Most trees with greater than 75% dieback died.

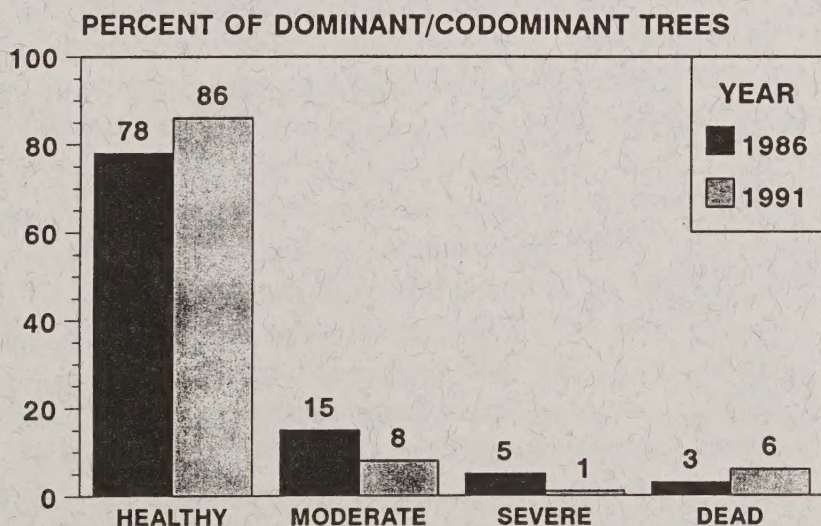
Local managers ascribe the improvement in the percentage of trees with high levels of dieback to higher precipitation in the last five years. The State of Vermont will publish a final report this summer. □



The DFTM Early Warning System

The Douglas-fir Tussock Moth (DFTM) Early Warning System was implemented in February, 1978. The survey system is primarily a management tool for focusing attention on potential trouble spots in the forests. The Forestry Sciences Lab in Corvallis, OR provided traps and baits for the first year - 1979. Starting in 1980, MAG agreed to supply traps to the field, while the Forestry Sciences Lab continued to supply the pheromone. For the 1992 season we have orders for 7,700 traps, which are manufactured here in Fort Collins by the Foothills Gateway Rehabilitation Center. Of these 7,700 traps, 2,245 will be used by Region 6 for a Western Spruce budworm population study. The DFTM data is collected from field survey sheets, computerized and sent to MAG, and stored on the Data General in a data base which provides an index of population changes of the moth. □

Crown Dieback Ratings, Vermont Hardwood Stands 1986 vs. 1991



Healthy=0-10% crown dieback, Moderate=11-50% crown dieback, Severe=>50% crown dieback, Dead=all standing dead except snags.

Quantitative Techniques Program

Pest Model Training in Pendleton

Instructors from Region 6 and MAG employees held a pest models training workshop for Region 6 personnel of the Wallowa-Whitman National Forest in Pendleton, Oregon, on March 31-April 2. Participants at the workshop were taught how to use the various pest model extensions with the Prognosis Growth and Yield Model.

Pest models covered included Douglas-fir Tussock Moth, Dwarf Mistletoe, Western Root Disease, Mountain Pine Beetle, Douglas-fir Beetle, and Western Spruce Budworm. Participants were also given information on how models are validated and calibrated and shown how the pest models have been integrated into INFORMS (Integrated Forest Resource Management System).

As part of the training, MAG employees developed a slide show, with student and

instructor notes, to be used during the Western Root Disease Model session. MAG employees developed the prototype training package to gain feedback from instructors and students on how future training sessions can be modified and improved.

Employees at MAG are also looking at developing a pest model training package with hypertext technology. Hypertext is a form of online documentation that allows users to jump back and forth within a file to select topics that interest them. Users can gain access to large amounts of information simply by highlighting a word or phrase within the online document. By using this technology to develop training materials for the pest model extensions, employees at MAG hope to enable users to train themselves at their own pace, and access only the information that pertains to them.

The next pest models training workshop is tentatively planned for fall of 1992. □

Permanent Plot Meeting and Review

In February, the Westwide Permanent Plot Committee met in Salt Lake City to discuss the results of the 1991 field season, review proposed activities for 1992, and distribute funds for conducting 1992 field activities. MAG is developing the database management system for the permanent plot project. The project plan for this system, developed in October 1991, has been reviewed and approved by the Permanent Plot committee.

The strategy and analysis phases of the project are close to completion. In April a meeting was held with an ORACLE consultant to review these two phases and to identify any factors which may be important to the subsequent phases of build, transition, and production. The strategy and analysis phases will be completed when MAG sends a list of all required data elements and codes to be used as the standards for this application to the Westwide Permanent Plot Committee. The build phase of the project will begin after the committee approves the completeness and correctness of the list of data elements and the standard codes. □

Systems Development Program

La Grande RD Uses INFORMS-DG for Five Points EIS

The La Grande Ranger District on the Wallowa-Whitman National Forest in Region 6 (R-6) is continuing its analysis of management alternatives for the Five Points area Environmental Impact Statement (EIS). The District is using INFORMS-DG (Integrated Forest Resource Man-

agement System on the Data General) to assist in the analysis of the alternatives as part of an R-6/FPM Technical Development Project (TDP).

The purpose of the TDP is to test the feasibility of using INFORMS-DG and its incorporated pest models in a complex multi-pest, multi-resource setting. The draft EIS will be completed this fall. Originally scheduled for completion in

fiscal year (FY) 1991, funding for the TDP has been extended through FY 1992. Evaluation of the implementation and use of INFORMS-DG at La Grande by the various cooperators has begun and will be documented in a Method Applications Group report later this year.

Contact Dave Roschke at (303) 498-2303 for additional information. □

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INFORMS-TX Workshop Held in Fort Collins

The Methods Application Group's Systems Development Program (SDP) sponsored a three-day workshop to explore the details of the INFORMS-TX (Integrated Forest Resource Management System - Texas) software. The workshop, which ran from April 14-16 in Fort Collins, included a wide range of topics and was attended by a broad cross-section of Forest Service and contract personnel. About 25 people attended.

INFORMS-TX is an integrated decision support system which incorporates GIS, DBMS, rulebase technology, and various resource models into a user-friendly system. Users access these needed tools through a graphical user interface (a windowing environment). The intent of this software is to simplify the process of developing complex forest

resource management alternatives, an ever growing task in District Offices. The current platform for INFORMS-TX is a SUN workstation.

At the workshop, Dr. Doug Loh of the STARR Lab at Texas A&M presented an overview of the design philosophy of INFORMS-TX. Other members of the STARR Lab were also on hand to provide technical details on the workings of this software. SDP staff members presented details on each of the major components of INFORMS-TX and led discussions on how to transfer this technology across the Forest Service community. Bobi Stiles, the original end-user of INFORMS-TX and a silviculturalist in Region 8, provided comments from a user's perspective on the value of this product, and also discussed her experience during

the development of INFORMS-TX over the last two years.

Much of the success of the workshop was due to the open atmosphere and the feedback and discussion generated by all participants. Other participants included Forest Service representatives from Timber Management, Land Management Planning, Forest Pest Management in the Northeast Area, Region 8, and from Region 6, where INFORMS-TX will next be installed in the Pine Ranger District.

At the conclusion of the workshop, Bobi Stiles and the STARR Lab staff each were presented MAG's Extra Effort Award for their dedication in making INFORMS-TX a reality.

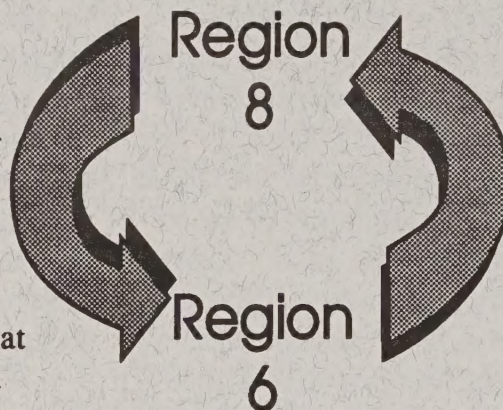
For information on the proceedings from this workshop, contact Patrice Janiga, (303) 498-2311. □

Systems Development Program

District Production Database and INFORMS

In the last issue of FPM Technology Update, we reported that MAG was investigating the possibility of a partnership with Region 6 to assess the transfer of INFORMS-TX workstation technology to that region. That partnership has evolved and a plan of work has been drafted. Region 6 Management Systems, Region 6 Forest Pest Management, the Wallowa-Whitman National Forest, and Washington Office (WO) Forest Pest Management will cooperate in a venture to place a Sun Workstation on the Pine Ranger District (RD). The INFORMS-TX prototype will be installed on the workstation.

The data structures, simulation models, and rulebases that are currently managed through INFORMS-TX are specific to Region 8, where all the work on the prototype up to this time has been done. The feasibility of replacing these R8 products with R6 products will be tested at the Pine RD, which is one of the District Production Database development sites. The Pine RD concentrated on existing vegetation data to produce the "Existing Vegetation" portion of the proposed "corporate" database. This data is now in use at several sites in Region 6. □



FPIS Summarizes 1991 Pest Data

The Forest Pest Information System (FPIS) was recently rewritten in ORACLE on the Data General. This system, which summarizes annual pest damage data nationwide, was running on the National Computer Center (NCC) Unisys computer using System 2000 until its removal this past winter. In developing the new FPIS on the Data General, the System Development Program used many of ORACLE's CASE tools, and also created special exception reports to help detect potential data errors.

During late March and early April, data were received from all Regions describing damage levels caused by various insects during 1991. These data were entered into FPIS through data entry screens created through SQL*Forms.

Using ORACLE's standard deviation function, 1991 data were compared against 1990 data to create the exception reports, highlighting potential errors. The final summaries created by FPIS contain insect damage levels by State and Region as well as national totals. Final reports should be forwarded to the Washington Office by May 1.

For more information, contact Steve Williams, (303) 498-1787. □

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former NASA camera system (Airborne Multi-spectral Photographic System - AMPS) on the Daniel Boone National Forest (Nationwide Forestry Application Program - NFAP)

Idaho - video evaluation for multi-pest surveys (R-4/FPM)

Colorado - photography of Forest Health Monitoring plots (R-2/FPM)

South Dakota - photography for evaluating stand conditions related to pest activity (Rocky Mountain Experiment Station). □

Upcoming Events

Upcoming Events

Event	Date	Place	Contact
GPS Training	June 16-18 June 23-25 July 21-23 Sept 15-17	University of Montana \$450 per student	U. of Montana Office of Continuing Education (406) 243-4623
Biometrics Training	November 2-6	St. Paul, MN	Eric Smith (303) 498-1845
RT-92 Washington, DC	August 3-7	Washington, DC	Bill White (303) 498-1777
RT-92 Taipei, Taiwan	November 16-20	Taipei, Taiwan	Bill White (303) 498-1777
Prognosis Training	October 26-30 November 2-6	Portland, OR	Judy Adams (303) 498-1727
Prognosis Training	September 21-24	Juneau, AK	Judy Adams (303) 498-1727

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Biometrics Training

MAG intends to offer a training course this fall covering topics relating to experimental design and analysis. Present plans call for the session to take place in St. Paul, Minnesota, the week of November 2-6. The session will last three to four days, covering experimental design, analysis of variance, regression analysis, and related topics.

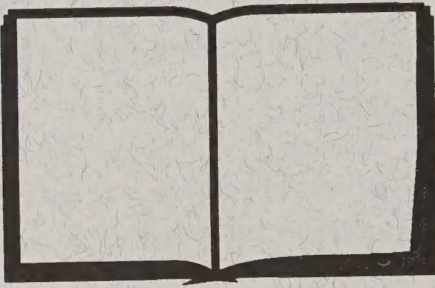
The session is intended

to increase the participants' ability to design efficient filed studies and to analyze results. It should also provide an increased ability to critically evaluate studies and research of others. Additional information will be made available as the session approaches.

Some FPM people have asked about a basic, introductory course in statistics. The USDA Graduate School offers

a correspondence course called "Elements of Statistics" (CSTAT350). The 15-lesson course is the equivalent of three semester hours of college work. The suggested prerequisite is elementary college algebra; the tuition is \$257, which includes all materials. □

Publications



USDA Forest Service. 1992. *Airborne Video User's Guide*. United States Department of Agriculture, Forest Service, Forest Pest Management Methods Application Group; Fort Collins, CO. MAG Report 92-1.

Vandygriff, J., Hansen, D. 1992. *Validation of the Mountain Pine Beetle Rate-of-Loss Model in Unmanaged Lodgepole Pine Stands of Northeastern Utah*. United States Department of Agriculture, Forest Service, Forest Pest Management Methods Application Group; Fort Collins, CO. MAG Report 92-2. 17 p.

Buffington, K. 1992. *Remote Sensing Techniques for Mapping Gypsy Moth Defoliation*. United States Department of Agriculture, Forest Service, Forest Pest Management Methods Application Group; Fort Collins, CO. MAG Report 92-3. 33 p.

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